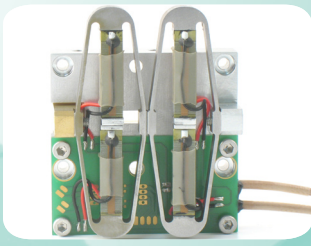


Fast Piezo Shutter FPS200M



The precise exposure of samples to X-ray beam is needed for reliable data acquisition. With modern synchrotron sources, the exposure times get shorter and the coordination between spindle movement and shutter opening needs to be accurate in order to get reproducible exposed images.

Objective

Developed in collaboration with Mr. Florent Capriani from EMBL, the fast piezoelectric shutter FPS200M (Fig.1a) constitutes two Amplified Piezo Actuators (APA200M) facing each other with a special optical head (Fig.1b). They are mounted on a solid stage to cut a laser or a X-Ray beam. When voltage is applied the two APA's contract and the shutter opens. The aperture size (Fig.2) is 0.35 x 5 mm. This normally close shutter is driven by a standard electronic board SP75A-2 (Fig.4) from CEDRAT TECHNOLOGIES.

Performances

Typical performances are given in the following table (Fig.3). This table is not exhaustive as many other Fast Piezo Shutter can be designed by CEDRAT TECHNOLOGIES starting with other standard amplified piezo actuators. For instance an APA400M based FPS400M provides more than 700µm of aperture.

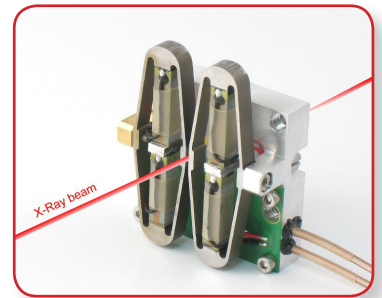


Figure 1a: FPS200M.

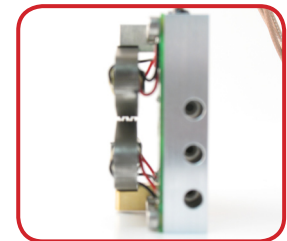


Figure 1b: FPS200M aperture optical head (zoom).

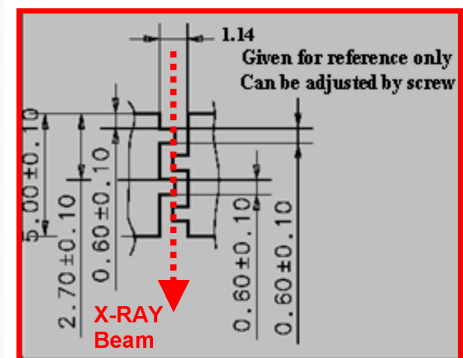
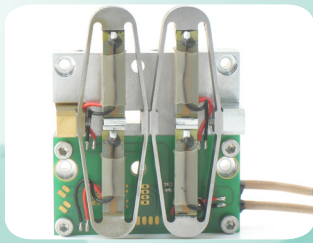


Figure 2: Dimensional view of aperture.

References	Unit	FPS200M	FPS400M
Item Code		V-FPSM200	V-FPSM400
Notes		-	-
Sensors option		SG	SG
Active axis		TX	TX
Max. No-load displacement (Tx)	µm	400	800
Max. beam diameter	mm	0,3	0,7
Voltage range	V	-20 ... 150	-20 ... 150
Stiffness	N/µm	3,17	0,10
Height (Z axis)	mm	21,0	21,0
Dimensions (X & Y axis)	mm	60 * 44	60 * 44
Mass	g	300	300
Unloaded resonance frequency (in the actuation's direction)	Hz	900	495
Response time	ms	0,56	1,01
Capacitance (per electrical port)	µF	3,15	3,15
Mechanical interfaces (payload)		4 slits (width 0.6 mm)	4 slits (width 0.6 mm)
Mechanical interfaces (frame)		4 holes Ø 3mm on [] 24*38 mm	4 holes Ø 3mm on [] 24*38 mm
Electrical interfaces		2 RG178BIU coaxial cables	2 RG178BIU coaxial cables

Figure 3: Characteristics of the Fast Piezo Shutter.

Fast Piezo Shutter FPS200M



In summary, FPS200M's offer:

- Very low jitter $\sim 100\mu\text{s}$
- Short response time $\sim 2\text{ ms}$. (In open loop with SP75A-2 switching power supply)
- Large displacement $> 300\ \mu\text{m}$
- Life time $> 10^{10}$ cycles
- Very good repeatability

Advantages:

- Vacuum compatible
- No Backlash, Stiction or Friction
- Immune to Magnetic Fields
- Ease of implementation
- No particles generated
- Highly compact assembly



Figure 4: SP75A-2 Rack.

References

- Fast Piezo Shutter presently operating successfully in below mentioned Beamlines for Macromolecular Crystallography: 7 Beamlines-ID14-1, ID14-2, ID14-3, ID14-4, ID23-1, ID23-2 & ID29 at ESRF, Grenoble - France (Fig.5).
- Already experimented successfully and to be integrated shortly at: 1 Beamline - PROXIMA 1 at Soleil - France.
- 2 Beamlines at Diamond -I24: Microfocus MX, I22: Non-crystalline diffraction - UK
- 4 Beamlines at APS Argonne Laboratory

Remarks

- CEDRAT TECHNOLOGIES is the only company to manufacture, test and establish successfully the Fast Piezo Shutter for X - Ray beamlines application.
- Its laboratories are equipped with a complete library of engineering software and specialized measurement apparatus.
- CEDRAT Group is a high technology French SME company with 15 years of experience in designing and developing Piezo based mechanisms.

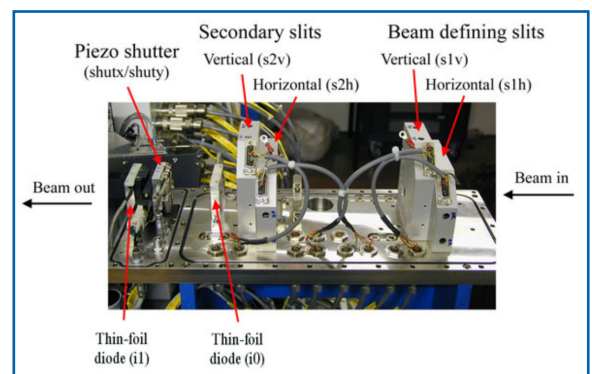


Figure 5: Experimental Table showing FPS200M (Courtesy ESRF).

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